A promising CO_2 separation proceess using gas hydrate crystallization

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CO_2 is a representative greenhouse gas causing global warming effects, and its emission is continuously increasing due to the use of fossil fuels. Therefore, it is necessary to separate CO_2 from the gas mixtures emitted from the plant. Several technologies including absorption, adsorption, and membrane separation can be applied to CO_2 separation, but these methods are economically inefficient as they require a pretty large amount of energy to operate, and the separation efficiency is not high enough. Gas hydrate is a crystalline compound in which gas molecules are captured in a lattice structure of water molecules connected by hydrogen bonds. The well-known crystal structures are sI, sII, and sH. Thermodynamic conditions required to form hydrates change with the gas species/compositions, and thus CO_2 can be selectively separated from the gas mixtures.

For such a process, chemical additives are often used to lower the pressure required to form hydrates and accelerate their formation. In this study, several amino acids including L-methionine, L-leucine, and L-isoleucine were used to promote CO_2 hydrate formation. The optimal selection and use of additives will be discussed.